numerous along the stem. A dash shows that the organs of the typical medusa are wanting.

It will be seen that I do not homologize the stem of *Agalma* with the stem of a fixed hydroid, but with the proboscis of a medusa. The Siphonophoræ are not free swimming hydroids, but medusæ with polymorphic individuals budding from it similarly to the condition in *Lizzia*. These buds are not zoöids but physiological and morphological individuals. I cannot follow Leuckart when he considers, however, that every bud is an individual. Three buds, the scale, the polypite and the tentacle together make one individual. Upon this subject we must look to embryology for light.

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DESTRUCTION OF OBNOXIOUS INSECTS BY MEANS OF FUNGOID GROWTHS.

BY PROF. A. N. PRENTISS.

[*Concluded.*]

Experiment No. 3.—May 10—A calla lily has become infested with aphides and red spider. The whole plant is carefully washed with a sponge except a small spot on one leaf where twenty-seven aphides are left, and a similar spot on another leaf where about twenty red spiders are left. The whole plant is sprinkled with domestic yeast, care being taken to thoroughly drench both the aphides and red spiders. The plant is covered by a bell jar which rests upon a ring of cotton batting, so as to shut the plant off from the approach of insects or spores from without, and prevent the escape of those within. Under the bell jar are placed two cups of actively fermenting yeast.

May 14.—The plant carefully examined. No dead aphides to be found. A number of cast-off skins are seen. The aphides are well scattered over the plant, but more than the original twenty-seven can be counted. The red spiders are also scattered so that the number cannot be ascertained. Several living but no dead ones are seen. That the spiders should have decreased in numbers might be expected from the moisture of the yeast independent of the Torulæ.

Experiment No. 4.—April 8.—Selected a thrifty rose geranium, about ten inches high, that had by count seventy aphides upon it, collected mainly upon the tender shoots.

The yeast is prepared by dropping pieces of compressed yeast-cake, bought at the grocer's, into Pasteur's fluid with sugar. In

about twenty-four hours the yeast has become active as is shown by frothing and the budding of the Torulæ observed under the microscope. This active yeast is sprinkled all over the plant, care being taken to wet the bodies of as many aphides as possible. Over the plant is placed a bell jar to isolate it from others.

April 11. — No effects noticed. Sowed more of the same yeast.

April 18.—The soil in the flower-pot has been allowed to become quite dry. The larger leaves of the plant have turned yellow, and upon these are nearly all the aphides. Counting as carefully as possible, the number is found to be three hundred and fourteen. The glass cover is removed and nearly all the aphides are brushed off, and the plant allowed a few days to recuperate.

Experiment No. 5.—May 1.—Sowed yeast procured direct from the bakery upon the same plant as in No. 4. Upon the plant are fifty-five aphides, mostly small. The plant is placed in a close Wardian case where there is an abundance of moisture.

May 6.—A mold (Mucor) has made its appearance upon all parts where the yeast adheres. The aphides are nearly all dead or dying. One aphis is found alive held to the stem of the plant by a pasty mass of yeast.

May 16.—Only three aphides alive; the mold has seriously injured the plant.

Experiment No. 6.—May 26. — Sowed yeast from the same bakery as in No. 5 upon the aphides on a healthy young plant of same kind and size as No. 4. This time the plant was not treated differently from others in the same room except being thoroughly sprinkled with yeast.

June 3.—Aphides as numerous as ever. No dead ones seen.

Experiment No. 7.—To ascertain whether any fungoid growths could be developed from the dead aphides in No. 5, two of them are placed on a bit of clean, broken plant crock sufficiently moistened, which is covered with a small bell glass, the rim of which rests in a shallow vessel of water to isolate the experiment as completely as possible. The experiment commences May 5, at 2 P. M. On May 6, at 3.30 P. M., some mycelium is visible on the body of an aphis.

May 9. — A number of upright hyphæ have fruited; the quantity of fruit is very small and not sufficient to determine what the mold is with certainty, but it appears to be a Mucor.

Experiment No. 8.—This experiment is introduced as a test of No. 7.

May 11.—Two aphides are taken from a plant which has been treated with yeast. One is dead when found, the other is killed; both are placed as in No. 7. No mycelium or fungoid growth of any kind is developed in this experiment.

Experiment No. 9.—This experiment was introduced for the same purpose as No. 8.

May 11.—5.30 P. M. Three living aphides are taken from a plant not treated with yeast, and killed and placed as in No. 7.

May 13.—The room has been quite cool and no mycelium has appeared.

May 15.—On one of the aphides a few fruits of a mold can be discerned. None can be seen on the other two.

This experiment seems to show that the mold developed in experiment No. 7 on the body of the aphis which had died, has no connection with the fact that the plant from which the dead aphis was taken, had been treated with yeast.

The result of these experiments, as a whole, as also many others not here recorded which have a more or less direct bearing upon the subject under consideration, indicate plainly that yeast cannot be regarded as a reliable remedy against such insects as commonly affect plants cultivated in greenhouses, rooms and parlors. Moreover, it is more than probable that the yeast would injure many kinds of plants, especially those with delicate foliage by spotting and soiling the leaves, and inducing fungoid growths upon the jars or soil in which the plants are grown. Indeed, in most greenhouses at the present time, it is not so much a question of keeping down injurious insects, as it is the suppression of molds and mildews of various kinds. The verbena rust only need be named as an illustration of this point.

Nearly all recorded experiments with the yeast fungus as an insecticide, have been attended only by negative results. Among these may be mentioned those of Prof. J. H. Comstock, of the Department of Agriculture, who fed caterpillars in breeding cages with leaves wet with dilute yeast. They seemed to thrive as well as others not thus fed.

Mr. Wm. Trelease tried last August a number of experiments with yeast upon the cotton-worm, in the vicinity of Selma, Ala.[1]

These experiments were varied and carefully conducted. In

[1] "Report upon Cotton Insects." J. H. Comstock, Dept. of Agr. Washington, 1879.

some cases the cotton plants upon which the worms were feeding were thoroughly drenched with active yeast. In one instance a number of the larvæ were placed in a tin box and drenched for twenty-four hours with yeast; after this the surplus yeast was drained off and the larvæ kept in the same box and fed for a week without showing any symptoms of disease. They were then sent to the department at Washington, where they arrived safely, and never gave those receiving them cause to suppose that they had been thus treated. Similar results attended all the experiments tried by Mr. Trelease, and he was led to the conclusion that the proposed remedy could not be utilized for the destruction of the cotton caterpillar.

On the other hand, Dr. Hagen mentions some experiments made last summer by Mr. J. H. Burns, of Shelter Island, N. Y., on the potato beetle, as being successful. A quantity of beetles was divided into two parcels, one of which was sprinkled on successive days with dilute yeast.

On the eighth day those sprinkled began to die, and on the thirteenth all were dead. Of the unsprinkled parcel only a few had died. That this experiment is decisive can hardly be claimed, as it is probable that some other substance, as for instance, dilute flour paste, which would favor the growth of fungi, might have had the same effect as the yeast. At all events, the experiment must necessarily be tried upon the beetles as they are found in their natural state infesting the potato plants, before any definite conclusion can be drawn.

It is true that Dr. Hagen found spores in quantity in the large sinus of the wing of the dead beetles which had been sprinkled, but it does not appear that these were in any way directly connected with the Torulæ of the yeast. It should also be noted that Dr. Hagen states in the May number of the Canadian Entomologist, for 1880, that he has recently received a letter from Germany, giving an account of the use of the diluted (compressed) yeast upon aphides in a green-house, "which was successful to an exceeding degree;" but no details in regard to the experiment are given.

Possibly the kind of yeast used may make a great difference in the result, although it should be remembered that three different kinds have been used in the experiments detailed in this paper.

It is also worthy of note that yeast, as suggested by Prof.

Metschnikoff, might in some cases prove destructive to insects to which it had been applied, not because of the yeast itself, but because of impurities which it might contain, it being an established fact that yeast may and often does contain the living spores of more than one kind of fungus.[1]

One of the things which is always taken into account in the cultivation of fungi in the laboratory, is the fact that when we purposely sow the spores of a given fungus we are never quite sure that we are not at the same time unconsciously sowing the spores of some other fungus which may be floating in the air. While we expect and generally obtain an abundant crop of the fungus we may wish to cultivate, we are apt to find here and there one or more other forms mingled with those we are trying especially to grow. These may be compared to the weeds which the gardener is pretty certain to find among the plants he has sown in his seed bed.

The subtle nature of fungoid growths of every grade, and the peculiar dependence of fungi upon climatic conditions and other circumstances, which are often unknown and wholly beyond control, are very important factors in estimating the probabilities of success by the methods under consideration. We know that epidemics and epizoötics of various kinds may be largely destructive and fatal one year, and the next, although the germs of disease must now be scattered in abundance everywhere, the disease is lessened or is wholly gone. Again, rust and smut may one season abruptly invade our grain-fields; the next it is scarcely seen; or blights and mildews may devastate for a few years our orchards and vineyards, and then gradually or suddenly disappear. Nor are these characteristics confined to microscopic fungi alone. During last season certain of the larger species, as Boletus and Hydnum, were sought in vain in localities about the University, where ordinarily they were abundant. The fall had been unusually dry and in this probably lay the cause of their non-appearance. Perhaps for the same reason, not a house-fly could be found that was affected with the Empusa, though they were sought for with much care, especially about the Botanical Laboratory where the yeast fungus was being grown.

Nevertheless, inasmuch as it is possible to suppress injurious fungi which destroy our economic insects, as for instance, the

[1] See *Nature* for March 11, 1880.

Muscardine in the case of the silk worm, the theory seems plausible that we may in time learn on the other hand, how to suppress injurious insects by fostering the growth of parasitic fungi which would spread infection among them and carry with it disease and death.

Finally, it must be confessed that the main question at issue is by no means decided, perhaps not seriously affected by the experiments and conclusions which I have here recorded. Though the yeast fungus may not be destructive to the insects named, and under the given conditions, it may, nevertheless, be destructive to other insects, or even to these under other conditions, or if the yeast fungus should prove to be wholly worthless and unreliable, it does not follow that there are not other forms which may be successfully employed as insecticides to the very great advantage of our most important national industry.

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LIST OF THE BIRDS OF THE WILLAMETTE VALLEY, OREGON.

BY O. B. JOHNSON.

[*Concluded from the July number.*]

40. *Poœcetes gramineus confinis* Bd. (Western grass finch).—Common during the summer, breeding extensively with the usual habits of the Eastern species.

41. *Chondestes grammicus* Say (lark finch).—Sparingly common during the summer, and breeding.

42. *Zonotrichia gambeli* Nutt. (Western white-crowned finch).—A very common summer resident, and nesting familiarly about gardens and thickets near dwellings.

43. *Zonotrichia coronata* Pall. (golden-crowned sparrow).—Sparingly common during summer and undoubtedly breeds, though I have not found its nest.

44. *Junco oregonus* Town. (Oregon snowbird).—Abundant during the winter and a few remaining to breed, the rest probably going to the mountains, where I hear of them. I have not yet seen its nest.

45. *Spizella socialis* Wil. (chipping sparrow).—A common summer resident, and breeding extensively with the usual habits of the species.